CHARLOTTE.

November 28, 2011

James Arden Barnett, Jr., Rear Admiral (Ret)
Chief, Public Safety and Homeland Security Bureau
Federal Communications Commission
445 12th Street S.W.
Washington, D.C. 20554

Re: Response to Your November 17, 2011 Letter; PS Docket No. 06-229, Request for a PLMN ID.

Dear Admiral Barnett:

The attached is the City of Charlotte's response to your letter dated November 12, 2011 in which you posed six groups of questions related to Charlotte's request for a permanent Public Safety Broadband Network PLMN ID.

Respectfully,

Charles L. K. Robinson
Director, Business Support Services

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1. *Please confirm Charlotte's preference for the use of a single PLMN ID for all waiver recipient networks, including Charlotte's. If that is not your preference, what is? Also has Charlotte coordinated this preference with the State of North Carolina and, if so, can you please provide evidence of this coordination.*

   The City of Charlotte (Charlotte) confirms its preference to deploy its network using a common single PLMN ID adopted by all waiver recipient networks and that this single PLMN ID will be maintained as these initial networks migrate to become part of a nationwide network. Charlotte is in the process of communicating and coordinating with the Statewide Interoperability Coordinator (SWIC) on this preference.

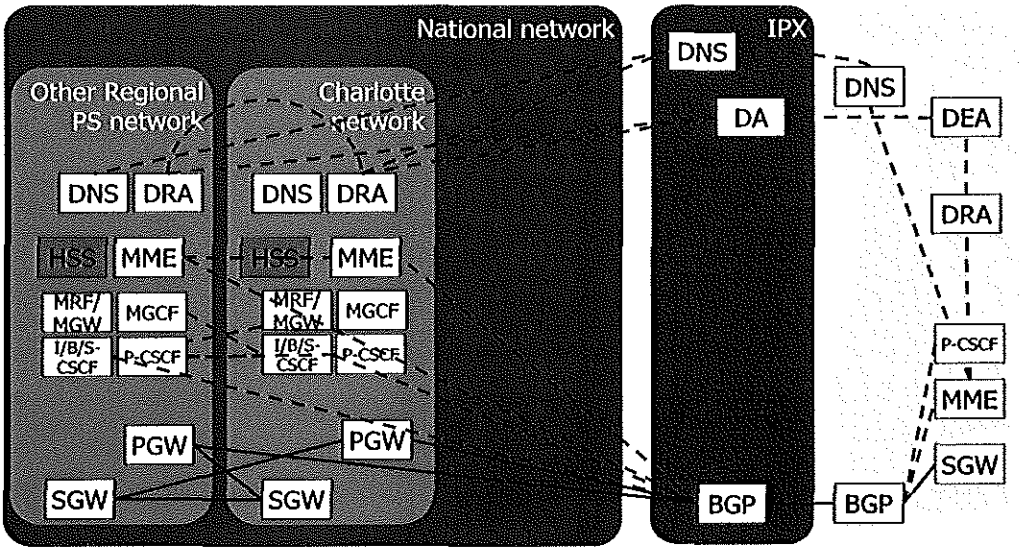
2. *What is Charlotte's plan for roaming on to a commercial network when other waiver operators, if they use the same PLMN ID as Charlotte, may also roam on to the same commercial network? How does this work technically and operationally? Is all necessary equipment and software developed that will allow the use of the same PLMN ID between Charlotte, the wavier operators and commercial roaming networks?*

   Charlotte is predominantly supportive of the Texas Interoperability Showing (v 8.0) and its subsequent answers provided on November 7, 2011. The Texas depictions, strategies, discussion and suggestions are not at odds with Charlotte's needs and plans.

   Charlotte and its suppliers plan to use the well known "Internetwork Packet Exchange" (IPX) specifications from the GSM Association (GSMA) as the basis for roaming on to a commercial network. This solution will require the implementation of a nationwide interconnection point or "Single PLMN Gateway" that supports the following functionality:

   - "DIAMETER Edge Agent" (DEA) / "DIAMETER Routing Agent" (DRA) to handle the routing of S6a and S9 messages between the commercial network and the particular waiver recipient network;
   - Central "Domain Name Server" (DNS) to expose waiver recipient network DNS records;
   - Network edge router that supports "Border Gateway Protocol" (BGP) to advertise IP routes and forward traffic flows to the particular waiver recipient network; and
   - Billing distribution (not shown) to direct roaming charges towards the correct waiver recipient network.

   The technical solution is outlined in the figure below:



From an operational viewpoint the IPX "DA" node would need to be configured to route incoming S6a messages to the correct waiver recipient network. This would be based on the IMSI number and an agreement is required between waiver recipients on the allocation of blocks of the MSIN field to individual waiver networks. This will most likely be based on the top 3 digits, corresponding to the 7th, 8th and 9th digits of the IMSI. Discussions with one of the IPX provider have indicated that this is a functionality they can provide. In addition, there will be a requirement for the distribution of roaming charges and the handling of payment. Also, the IPX BGP router function would require either manual or automatic establishment of IP routes to the individual waiver recipient networks.

Charlotte is currently in discussions with a third party IPX Service Provider to establish the "Single PLMN gateway" for its own use and recommends that the other waiver recipients share this facility.

While the exact instantiation of a small number of technology or systems pieces by Charlotte may differ from those of Texas and other jurisdictions, the end result of interworking ('Intra-System Mobility') and 'Inter-System Roaming' is effectively the same. While Charlotte uses a hosted solution – in part because we believe that to be a more cost-effective approach – the protocols, routing, authentication and accounting are similar if not the same. For example, one of the most critical aspects – routing – is NOT novel in the sense of routing data per IPv4 or IPv6. The remaining work or work product to be completed is within typical 2011-2012 technology and tradecraft.

The preponderance of the equipment and software needed to support interworking and inter-system roaming is now available. The subset that is not available is 'shovel-ready' project work that can be completed within usual and typical timelines at typical levels of risk. Charlotte's understanding is that the public safety community (Texas, PSST-OAC, PSCR, and others) have thoroughly debated and vetted various aspects – technical and operational - of these systems and now these entities require more certainty in order to advance to the next steps. Such certainty might be created by FCC action. We are relatively pleased by the progress of these organizations and the vendor community to come together and design a fully interoperable solution.

3. *What is Charlotte's plan to ensure interworking (i.e., roaming and interconnectivity among waiver jurisdiction deployments) prior to full migration to a nationwide network? How does this work technically and operationally? Will this be available on day one of deployment as required by Charlotte's waiver authorization?*

Charlotte plans to adhere to FCC Orders regarding interworking by the Service Availability date in the beginning of July 2012. Charlotte is a full participant in PSST-OAC and other communities. Moreover, Charlotte has already been in consultation with other early go-live waiver recipients such as Texas. Please note that the approach by Charlotte presumes a great many aspects of the Texas showing and answers are incorporated herein by reference.

Provided all waiver recipients adopt the single PLMN ID approach, interworking between networks would be achieved on a direct bi-lateral basis with local "DIAMETER ROUTING AGENT" (DRA) used to route S6a (HSS-MME) and, if required, Gx (PCRF-PGW) and Rx (Application-PCRF)

interfaces between waiver recipient networks. In addition, the necessary DNS information would be exposed to other waiver recipient networks sharing the same PLMN ID.

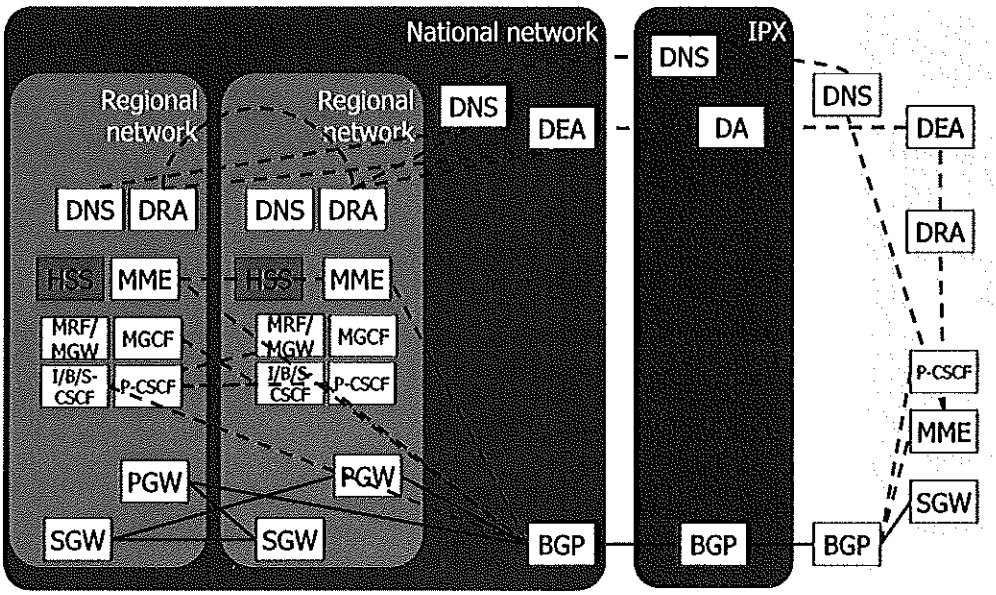
At an operational level this solution would rely on the same agreement between waiver recipient networks for the assignment of IMSI blocks to networks as per the solution outlined above for roaming on to commercial networks. However, since this interworking is now on the basis of a single PLMN, then roaming charges between networks do not need to be distributed and the waiver recipients would not need to route traffic over third party networks.

Please note that Charlotte's Phase 1 objectives include LTE network support for the Democratic National Convention and as such aims to be operational June 30, 2012.

4. *What is Charlotte's plan for transition of the Charlotte network to a nationwide network with a single PLMN ID? Has Charlotte coordinated such an approach with other waiver jurisdictions? How will this transition of the Charlotte network into a nationwide network with one PLMN ID affect other network identification codes, such as Tracking Area Codes (TAC), PDN identifiers, eNodeB Identifiers, and Mobility Manager Entity Group Identifier (MMEGI), and how will they be managed technically and operationally? What are the cost factors that would be involved?*

   Based on the technical and operational solutions outlined above, the transition to a nationwide network with a single PLMN ID will be a relatively straight forward process provided that the initial assignment of blocks of IMSI agreed between waiver recipients is included within the eventual solution adopted at the nationwide level. This should not represent a major risk provided the initial blocks are sensibly assigned using a methodology that allows for a scalable solution in the long term without imposing excessive fragmentation of the MSIN number space. For example, if the initial assignment is made on the basis of specific values of the top 3 digits to each waiver recipient (i.e. specific 7^{th}, 8^{th} and 9^{th} digits of the IMSI) and these values are spread across the entire number space using an understanding of the eventual needs of each FEMA region/state(s), then a future safe solution should be possible to define. To this end, Charlotte is predominantly supportive of the Texas version v8.0 interoperability showing and its subsequent answers on November 7, 2011. Specifically, we believe the research and analysis performed by Texas and PSCR is robust and is vetted by the public safety community. Charlotte concurs with the Texas position with regard to other Network Identifiers.

   From a technical viewpoint, it is expected that the transition to a nationwide network would be performed through the introduction of a central node operated by or for the nationwide network PLMN ID holder that each network would use as a common interworking point as shown in the picture on the following page.



In addition to the IMSI other network identification codes such as TAI, MMEGI, and ECGI need to be coordinated. Charlotte recommends that the waiver recipient networks adopt an initial assignment of these codes using the top 4 bits of the upper Byte of the field following the MNC field (i.e. the TAC, MMEGI and ECI fields respectively) to point to the FEMA region and then the second 4 bit zone of the upper Byte used to identify the specific waiver recipient network within a given FEMA region. This solution would allow a smooth transition towards a nationwide network that minimizes the need for costly re-numbering procedures, and is largely in line with the Texas and PSCR proposals.

Charlotte notes that any change of the assignment of MSIN number blocks would result in the need to physically swap out the SIM cards installed in the individual public safety mobile devices. This would require significant network down-time, and be a costly and time consuming process which all stakeholders should seek to avoid.

5. *If Charlotte uses a single PLMN ID in common with other waiver jurisdictions and ultimately with a nationwide network, will there be a subsystem of identification of Charlotte and other jurisdictions? Will such a system use the seventh, eight and perhaps higher order digits of the international mobile subscriber identification in order to identify the jurisdiction? If so, will this limit the number of individual users on the network or in any way impact the ability to support non-public safety users? Since this is not the way that commercial entities use the code, are there other consequences that would impact the operation of the network? IF this is not the way Charlotte and other individual jurisdictions will be identified on the network, what method will be used?*

As outlined above, Charlotte recommends that the top 3 digits of the MSIN field in the IMSI, corresponding to the 7th, 8th and 9th digits of the IMSI be used as the basis of the "subsystem of identification" of Charlotte and other jurisdictions. This solution is consistent with the Texas and PSCR proposals, and allows allocation by FEMA and/or state(s) based on projected needs. Charlotte understands that assignment of MSIN on the basis of these 3 digits is the reasonable compromise between the size of the DRA/DEA routing tables and the potential waste of IMSI

numbers if an excessive number of very small networks are built with each being assigned a dedicated number block range.

Charlotte understands that this approach is not the normal way commercial entities use this code when dealing with roaming between networks however we understand that within these commercial networks ad hoc assignment of IMSI number ranges in blocks of 1-10 million numbers to individual HSS nodes is a common practice and so routing on the basis of the top 2 or 3 digits on the MSIN field is a well known approach on commercial networks.

6. *Based on your recent quarterly report as supplemented, we understand that Charlotte's operational date is June 30, 2012. Given your responses to the questions above, what actions must be taken to ensure that you meet your deployment scheduled? To what extent that any action is dependent on parties not affiliated with Charlotte, how can you ensure that any action is done within the deployment timeframe?*

Actions necessary to ensure the success of the Charlotte deployment schedule include:

- Consensus of the Public Safety Spectrum Trust Operating Advisory Committee to support the use of a single PLMN ID and IMSI block assignments.
- Swift actions by the Federal Communications Commission (FCC) to support this structure thereby creating the certainty and sufficient structure so that network planning and design work can be completed immediately. A variety of matters have been suggested by the extended public safety community and Charlotte predominantly supports these.
- With the announcement from Representative Greg Walden (R., Ore.), Chairman of the House Communications and Technology Subcommittee, that work on advancing H.R 2482 would begin in early December, Charlotte is confident in the long term success, sustainability and effective governance of the National Public Safety Broadband Network. However, critical governance issues must be addressed in the short term to ensure the success of all early buildings, including Charlotte. Therefore, Charlotte requests that the FCC implement the Texas "Concluding Recommendations" (Section H) of the Texas November 7, 2011 response to ensure an adequate interim governance structure.
- Charlotte requires a commitment to a PLMN ID framework by mid-January 2012.
- Upon Charlotte's agreement to abide by the framework associated with a common PLMN ID as proposed, the FCC would authorize use of the PLMN ID by February 24, 2012.

Lastly, Charlotte would like to make known its intent to advance a "no intra-system mobility fee" strategy among state and local public safety LTE networks. Our rationale is that such roaming is most likely in support of mutual aide requests during emergency response scenarios and would otherwise be so small as to be insignificant. Scarce economic resources should not be used on system accounting and charging aspects between jurisdictions.